

Management of Arizona's Wildlife Habitat

**An analysis of selected habitat types for use in Arizona's
Comprehensive Wildlife Conservation Strategy**

**Submitted to Arizona Game and Fish Department
by
The Nature Conservancy in Arizona**



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Introduction

Identifying the primary managers of wildlife habitat can provide one useful type of information for development of Arizona's Comprehensive Wildlife Conservation Strategy. This can contribute to satisfying at least three of the required elements: #4 (conservation actions and priorities), #5 (monitoring plans), and #7 (coordination). This can be particularly useful in the prioritization of actions and resources.

Toward that end, The Nature Conservancy has compiled relevant information and conducted new analyses from our recent statewide efforts to map and analyze two natural communities, grasslands and forests, and a species group, native fish. The results are presented in three sections, with appendices describing data sources.

1. Fish Habitat in Perennial Streams

Native fish may be the vertebrate species group that has suffered the greatest declines, and for which habitat protection is most urgent. As part of The Nature Conservancy's ongoing efforts to focus and prioritize our efforts at conserving biological diversity, we recently developed a digitized mapping of the distribution of Arizona's native fish species (Figure 1). The intent was to identify places in need of greater conservation efforts, particularly those streams with the greatest species richness, on the principle that it is most efficient to first protect streams with the most native species, then focus on extremely rare species that occur in smaller assemblages.

Comparing the results with land management status produced several insights. Private lands control streams occupied by the greatest total number of species (Figure 2), and the third-highest total length of occupied stream reaches. The US Forest Service and tribal lands contain the greatest amount of fish habitat, both occupied and potential (Figure 3). Looking at just those streams with five or more native fish species present, the Forest Service has more than double the stream miles of habitat than either tribal or private lands (Figure 4).

Looking at finer levels of management reveals details such as that the San Carlos Apache Reservation has the highest species richness, but the White Mountain Apache Reservation has the greatest amount of perennial stream habitat (Table 1). This difference could be an artifact of data limitations, since lack of species presence data led to many streams on the reservations being attributed as "0 or no data."

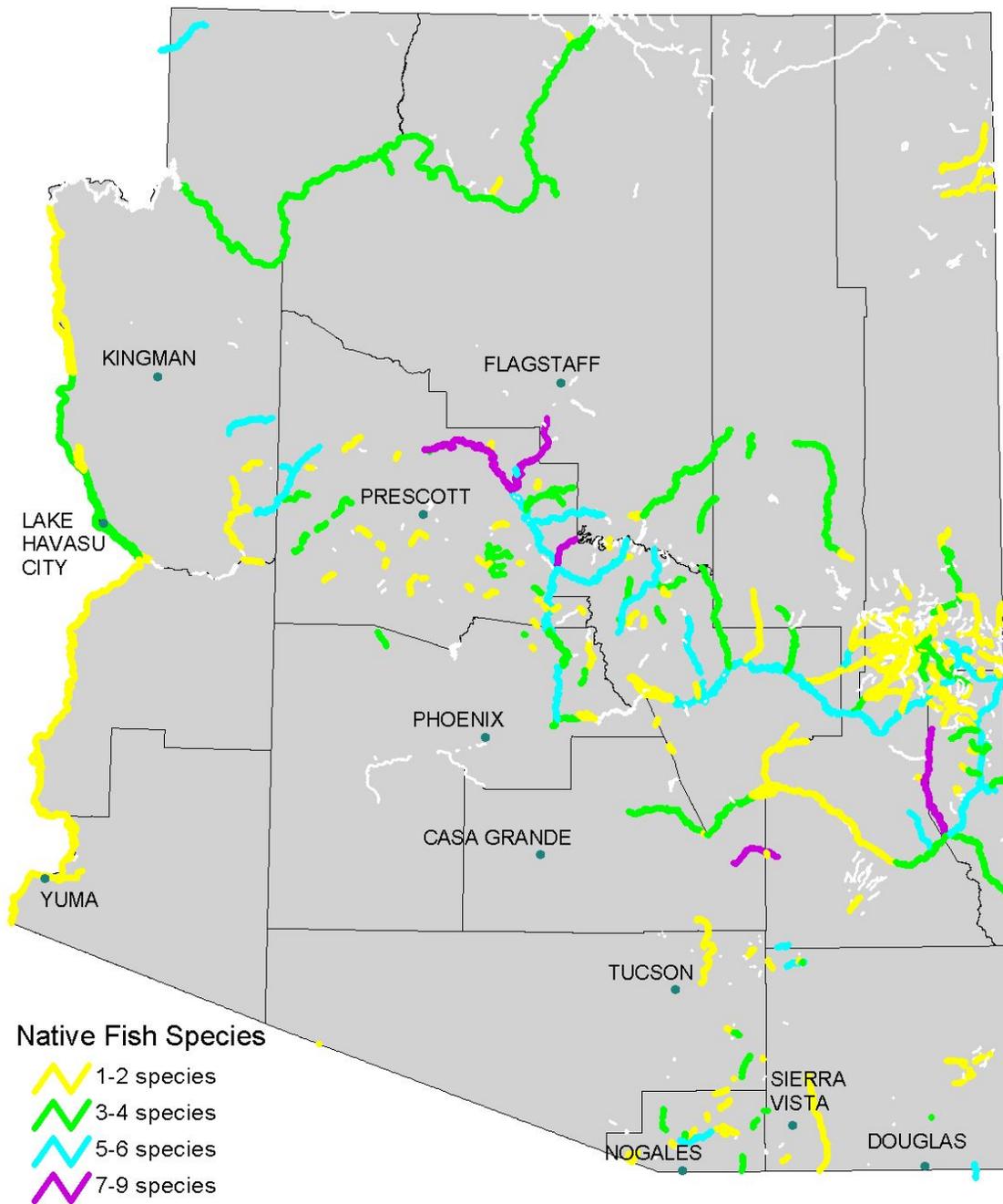


Figure 1. Native fish species richness in Arizona's perennial streams. Values include introduced populations. White lines represent perennial stream reaches with zero native species present or a lack of data.

Figure 2. Total native fish species by manager for Arizona.

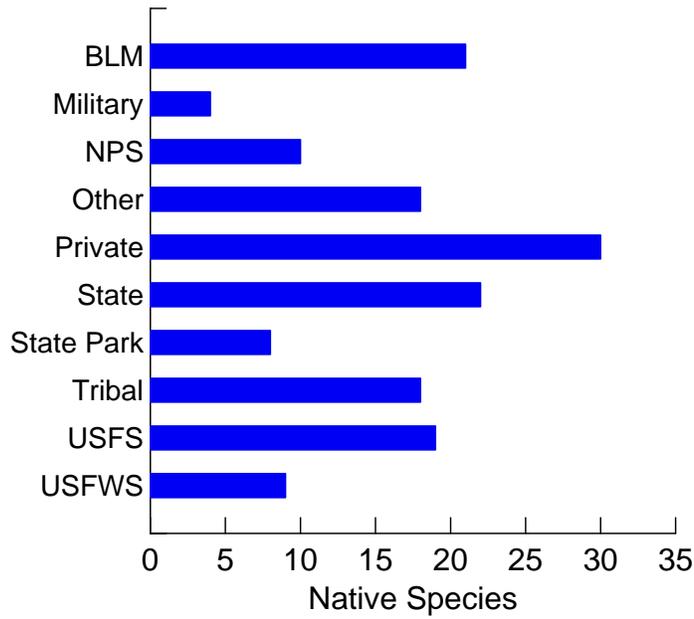


Figure 3. Native fish habitat by manager for Arizona.

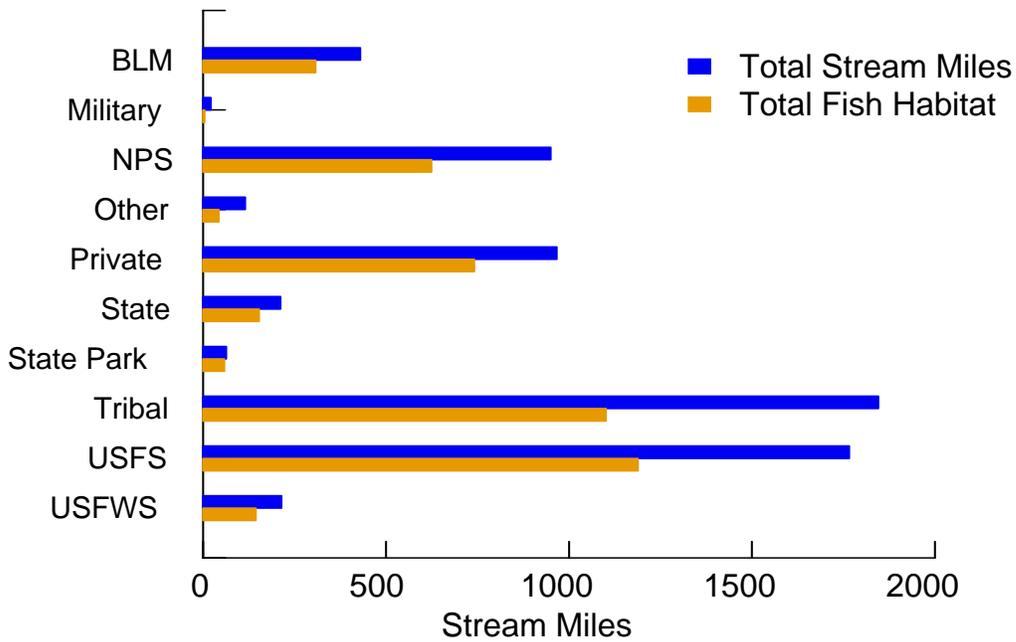


Figure 4. Native fish habitat by manager and number of species present. Zero species values represent perennial stream reaches where native fish are not present or where fish presence data are lacking.

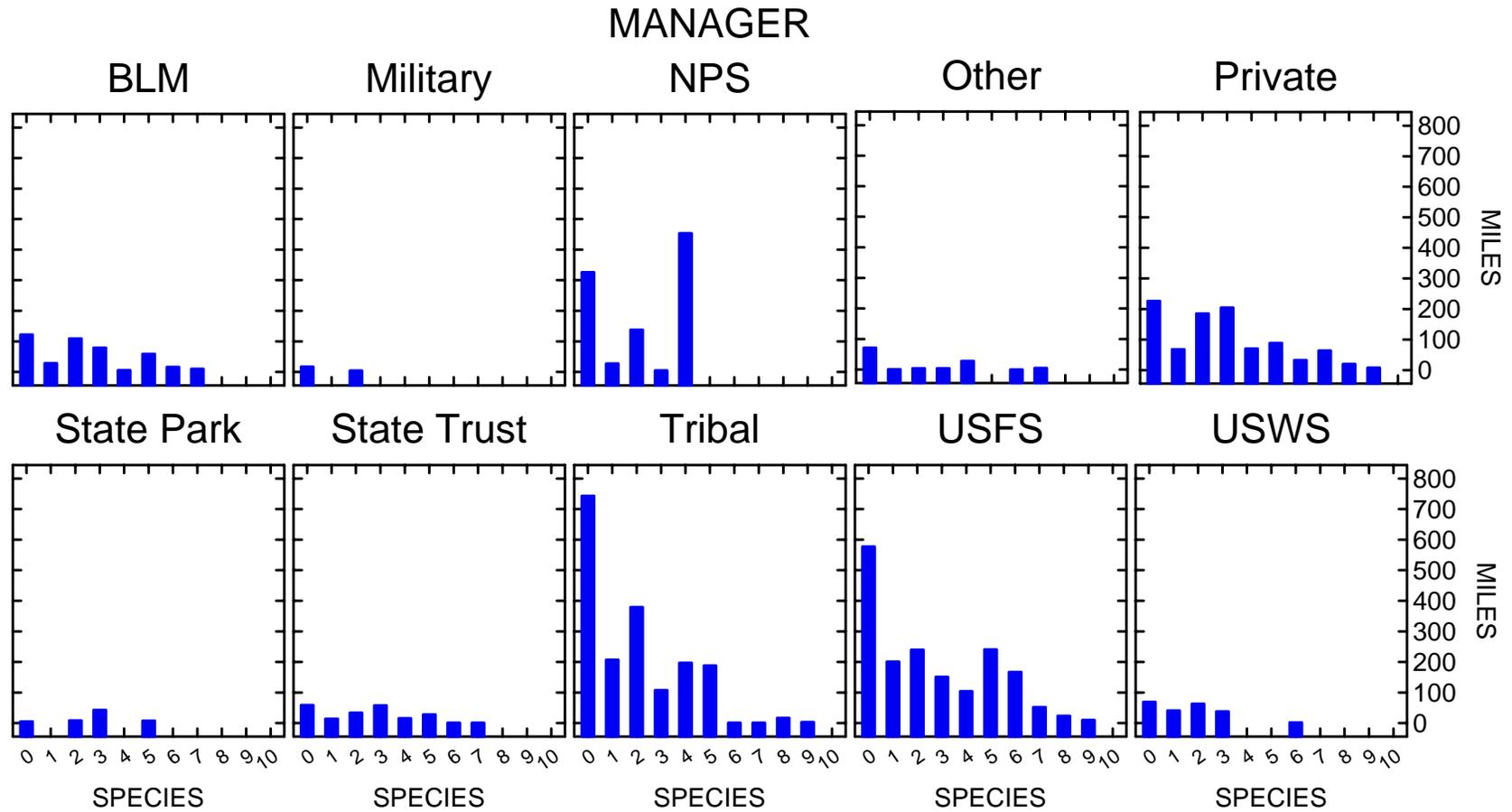


Table 1. Native fish distribution by management area.

| Agency | Management area | Species | miles with fish | miles total perennial |
|---------------------------|------------------------------|---------|-----------------|-----------------------|
| Bureau of Land Management | Arizona Strip Field Office | 6 | 18 | 50 |
| Bureau of Land Management | Kingman Field Office | 6 | 67 | 71 |
| Bureau of Land Management | Lake Havasu Field Office | 3 | 5 | 18 |
| Bureau of Land Management | Phoenix Field Office | 8 | 27 | 42 |
| Bureau of Land Management | Safford Field Office | 12 | 84 | 93 |
| Bureau of Land Management | Tucson Field Office | 6 | 60 | 64 |
| Bureau of Land Management | Yuma Field Office | 4 | 47 | 91 |
| National Forest | Apache-Sitgreaves N.F | 13 | 436 | 714 |
| National Forest | Coconino N.F | 14 | 128 | 188 |
| National Forest | Coronado N.F | 10 | 76 | 139 |
| National Forest | Kaibab N.F | 0 | 0 | 7 |
| National Forest | Prescott N.F | 10 | 78 | 88 |
| National Forest | Tonto N.F | 10 | 470 | 630 |
| Indian Reservations | Cocopah Indian Res. | 2 | 5 | 5 |
| Indian Reservations | Colorado River Indian Res. | 2 | 63 | 77 |
| Indian Reservations | Fort McDowell Indian Res. | 5 | 15 | 15 |
| Indian Reservations | Fort Yuma Indian Res. | 2 | 0 | 1 |
| Indian Reservations | Fort-Mohave Indian Res. | 3 | 14 | 22 |
| Indian Reservations | Gila River Indian Res. | 0 | 0 | 22 |
| Indian Reservations | Havasupai Indian Res. | 3 | 6 | 6 |
| Indian Reservations | Hualapai Indian Res. | 4 | 110 | 114 |
| Indian Reservations | Indian Allotments | 9 | 1 | 1 |
| Indian Reservations | Kaibab Indian Res. | 0 | 0 | 6 |
| Indian Reservations | Navajo Indian Res. | 4 | 82 | 511 |
| Indian Reservations | Salt River Indian Res. | 5 | 5 | 5 |
| Indian Reservations | San Carlos Indian Res. | 11 | 232 | 260 |
| Indian Reservations | White Mtn Apache Indian Res. | 7 | 565 | 800 |
| Indian Reservations | Yavapai Apache Indian Res. | 8 | 1 | 1 |
| Local or State Parks | Parks and Recreation | 8 | 58 | 63 |
| Military | Fort-Huachuca | 0 | 0 | 2 |
| Military | Military Res. | 4 | 4 | 19 |
| National Park | Canyon De Chelly N.M | 2 | 36 | 43 |
| National Park | Glen Canyon N.R.A | 4 | 32 | 70 |
| National Park | Grand Canyon N.P | 4 | 413 | 455 |
| National Park | Hubble Post N.H.S | 0 | 0 | 0.5 |
| National Park | Lake Mead N.R.A | 6 | 120 | 357 |
| National Park | Marble Canyon N.M | 4 | 21 | 21 |
| National Park | Montezuma Castle | 4 | 2 | 2 |
| National Park | Montezuma Well | 4 | 1 | 1 |
| National Park | Organ Pipe N.M | 1 | 0.3 | 0.3 |
| Other | Bureau of Reclamation | 9 | 27 | 62 |
| Other | County Land | 7 | 1 | 17 |
| Other | Game and Fish | 15 | 15 | 36 |
| Private | Private Land | 30 | 741 | 967 |
| State Trust | State Trust Land | 22 | 153 | 212 |
| National Wildlife Refuge | Cibola N.W.R | 2 | 12 | 38 |
| National Wildlife Refuge | Havasus N.W.R | 3 | 91 | 98 |
| National Wildlife Refuge | Imperial Mtn N.W.R | 2 | 39 | 75 |
| National Wildlife Refuge | San Bernardino N.W.R | 6 | 2 | 2 |

2. Grassland Habitat

Arizona’s grasslands have undergone dramatic vegetation changes over the last 130 years, including encroachment by shrubs, loss of perennial grass cover, and spread of non-native species.

These changes have affected a variety of animal species in addition to the plant communities. While not all animals associated with grasslands are strictly dependent on natural conditions, at least 23 native species of grassland mammals and birds in the Southwest have been extirpated or have experienced significant range reductions (Brown and Davis 1995).

To assess grassland conditions, we developed a series of grassland classes or types using information from range management experts and the literature to define threshold values for shrub cover. The classes include: native grassland with low shrub cover (Type A); shrub-encroached native grassland with restoration potential using prescribed fire (Type B); sacaton riparian grassland (Type C); non-native grassland with low shrub cover (Type D); shrub-encroached non-native grassland (Type E); and former grassland that has undergone a type conversion to shrubland (Type F).

Using these grassland classes, we interviewed 39 range management specialists and had them draw areas on maps. The results were field verified, and refined as needed (Figure 5, Appendix 1).

Most current and historic grasslands of known status in Arizona occur on private and state trust lands (Table 2). Open native grasslands (Types A, A&D) and those which are restorable to native grassland conditions (Types B, A&B) comprise 10.9 million acres statewide, of which 37% are in private management. Sacaton grasslands (Type C) comprise 37 thousand acres, of which 64% are in private management.

Table 2. Extent, in acres, and percent abundance of grassland types by land manager (BLM, ASLD, Private) and for Arizona overall (total).

| Grassland Type | BLM Acres | % BLM Land | State Acres | % State Land | Private Acres | % Private Land | Total Acres | % All* |
|----------------------------|-----------|------------|-------------|--------------|---------------|----------------|-------------|--------|
| Open Native (A, A&D) | 492,935 | 9 | 1,423,461 | 27 | 2,316,359 | 45 | 5,200,961 | 31 |
| Native Restorable (B, A&B) | 947,841 | 17 | 1,801,911 | 32 | 1,754,477 | 31 | 5,655,570 | 34 |
| Riparian (C) | 449 | 1 | 9,556 | 26 | 24,013 | 64 | 37,361 | 0 |
| Exotic (D, E) | 17,458 | 1 | 496,675 | 34 | 637,854 | 44 | 1,456,340 | 9 |
| Historic (F) | 1,049,033 | 28 | 1,090,623 | 30 | 867,641 | 23 | 3,694,395 | 22 |
| Transition (T) | 234,930 | 34 | 117,353 | 17 | 315,490 | 46 | 683,134 | 4 |
| UNK | 45,304 | 1 | 60,816 | 1 | 142,638 | 2 | 7,772,725 | |
| Total | 2,787,951 | 11 | 5,000,394 | 20 | 6,058,472 | 25 | 24,500,486 | |

* Value represents the percentage of the total grassland acreage for each grassland type excluding UNK grasslands.

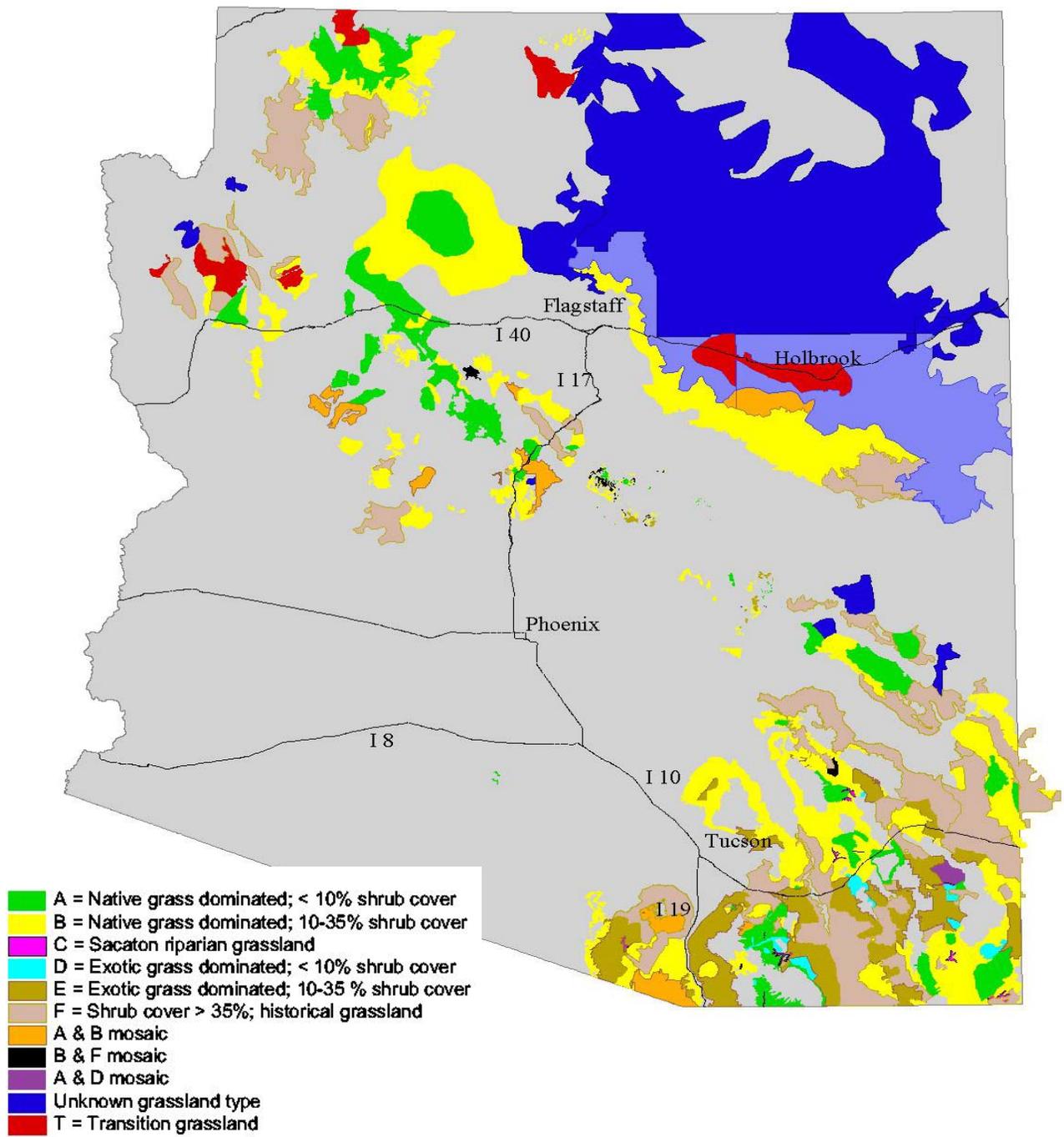
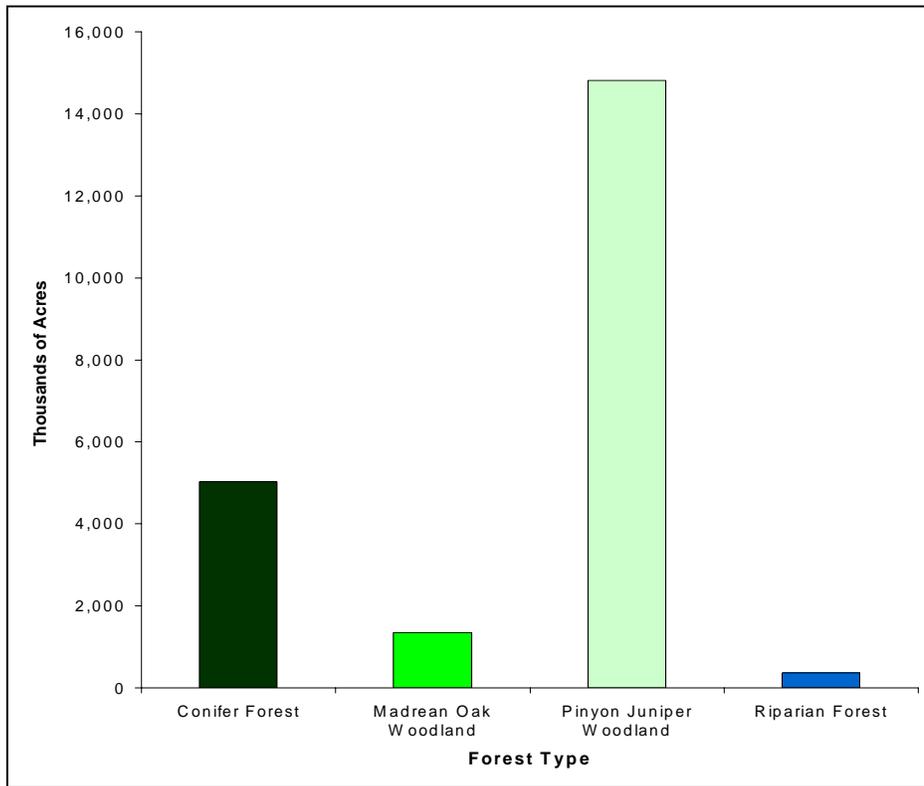


Figure 5. Arizona grassland habitat extent and condition.

3. Forest Land Habitat

Forests comprise the primary habitat for a variety of Arizona’s wildlife species. The diversity of Arizona’s forests range from semi-arid riparian gallery forests to sub-alpine and montane forests, spanning roughly 27 % of the state. The majority of forest land is located above the Mogollon Rim with discrete patches in southeastern Arizona’s mountain islands (Figure 7). Pinyon-juniper and pure juniper woodlands are the most abundant forest type in Arizona, occupying approximately 14.8 million acres or 20.3 % of the state (Figure 6). The rarest and most significant in ecological terms is riparian forest, which occupies less than one half a percent of Arizona’s land. For this analysis, multiple categories from the GAP vegetation mapping and AGFD’s riparian vegetation mapping were grouped into four categories: conifer forest, Madrean oak woodland, pinyon-juniper woodland, and riparian forest (Appendix 2).

Figure 6. Area covered by forest type in Arizona (in thousands of acres).



When all forest types are considered together, the largest amount of forest lands (42%) are administered by USDA Forest Service, 31% are tribal lands, and 10% are private. However, those proportions vary by forest type (Table 3). Most notably, private lands control the largest share of the riparian forests.

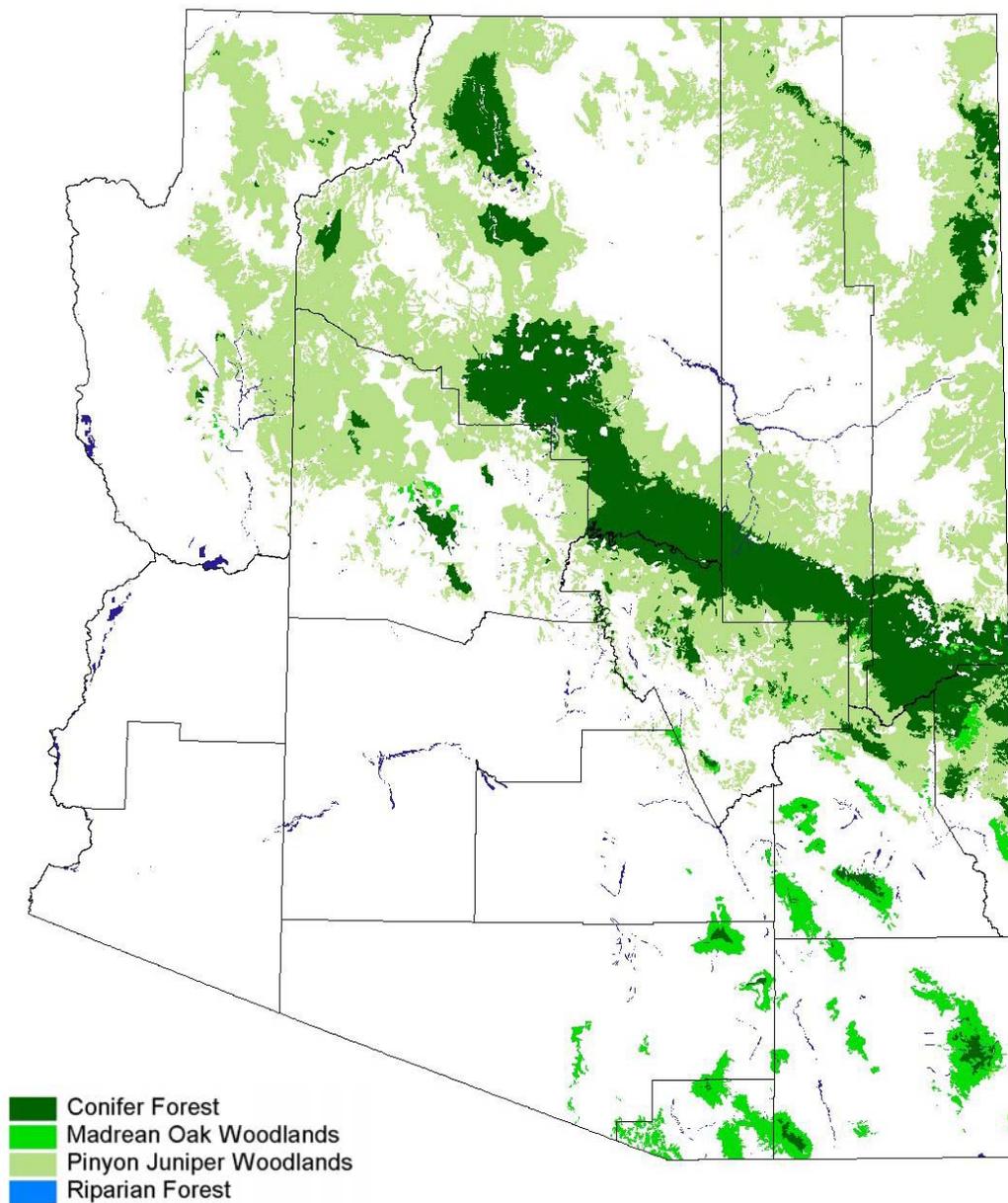


Figure 7. Distribution of Arizona's forest habitat.

Table 3. Land management of Arizona's forests. Managers are sorted in descending order according to total acreage of forest lands, as derived from GAP vegetation and AGFD riparian mapping, along with ALRIS land ownership data.

| Management | Conifer Forests | | Madrean Oak Woodlands | | Pinyon Juniper Woodlands | | Riparian Forests | |
|----------------------------|-----------------|------------------|-----------------------|------------------|--------------------------|------------------|------------------|------------------|
| | Total Acres | % of forest type | Total Acres | % of forest type | Total Acres | % of forest type | Total Acres | % of forest type |
| US Forest Service | 3,239,174 | 64.4 | 940,236 | 69.5 | 3,251,232 | 21.9 | 22,673 | 8.8 |
| Indian Reservation | 1,440,996 | 28.6 | 110,362 | 8.2 | 5,699,797 | 38.5 | 58,157 | 22.6 |
| Private | 138,513 | 2.8 | 117,354 | 8.7 | 2,341,558 | 15.8 | 82,189 | 31.9 |
| Bureau of Land Management | 19,067 | 0.4 | 61,331 | 4.5 | 1,573,348 | 10.6 | 43,906 | 17.1 |
| State Trust | 34,975 | 0.7 | 80,841 | 6.0 | 1,440,861 | 9.7 | 32,092 | 12.5 |
| National Park Service | 122,164 | 2.4 | 25,043 | 1.9 | 512,085 | 3.5 | 11,591 | 4.5 |
| Military | 32,756 | 0.7 | 17,123 | 1.3 | 0 | 0.0 | 598 | 0.2 |
| Arizona Game and Fish | 660 | 0.0 | 549 | 0.0 | 3,447 | 0.0 | 725 | 0.3 |
| Other | 1,748 | 0.0 | 289 | 0.0 | 381 | 0.0 | 2,270 | 0.9 |
| US Fish & Wildlife Service | 0 | 0.0 | 268 | 0.0 | 0 | 0.0 | 3,283 | 1.3 |
| TOTAL | 5,030,053 | | 1,353,395 | | 14,822,710 | | 257,483 | |

Literature Cited

- Brown, D.E. and R. Davis. 1995. One hundred years of vicissitude: terrestrial bird and mammal distribution changes in the American Southwest, 1890-1990. Pages 231-244 in L.F. DeBano, ed. Biodiversity and management of the Madrean Archipelago: the sky islands of southwestern United States and northwestern Mexico. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.
- Gori, D.F., and C.A.F. Enquist. 2003. An assessment of the spatial extent and condition of grasslands in central and southern Arizona, southwestern New Mexico and northern Mexico. The Nature Conservancy, Tucson, AZ.
- Schussman, H., and D. Gori. 2004. An Ecological Assessment of the Bureau of Land Management's Current Fire Management Plans: Materials and Recommendations for Future Fire Planning. Report to Bureau of Land Management, Arizona State Office, Phoenix, Arizona. 101 pp.
- The Nature Conservancy. 2004. Arizona Forest Legacy Program: Assessment of Need. Report to Arizona State Land Department, Fire Management Division, Phoenix, Arizona. 269 pp.

Appendix 1. Data Sources

Section 1. Fish Habitat

For the underlying distribution map, we used digitized point localities from the Arizona Game & Fish Department's Heritage database and Wendell Minckley's database of ichthyology specimens. We limited the data to recent records, 1975 or later. We used perennial stream segments from the Arizona State Land Department (ALRIS) digital file. We attributed each stream segment with each native fish species found there, using available literature and making assumptions to interpolate distribution between points. The resulting maps have been reviewed by Rob Bettaso (AGFD), Peter Unmack (ASU), Doug Duncan (USFWS), and others, with their input being used to refine the mapping for each species.

Section 2. Grassland Habitat

The underlying data set and portions of these analyses were presented in two reports: Schussman and Gori 2004, and Gori and Enquist 2003.

To develop the grassland assessment, we used an expert-based approach to develop a broad-scale, rapid assessment of Arizona's grasslands, interviewing 39 range management specialists from the Forest Service (USFS), Natural Resources Conservation Service, Bureau of Land Management (BLM), University of Arizona, Arizona State Land Department, The Nature Conservancy and New Mexico Natural Heritage Program. Expert input was verified and corrected where necessary through extensive field reconnaissance and quantitative vegetation sampling at 436 random sampling points. The original expert maps were corrected based on data from field sampling points, notes made while traversing polygons, and field mapping.

We estimated the accuracy of the original, uncorrected expert map as the percent of field sampling points and monitoring plots that "agreed" with the expert's determination for that area. Using this approach, 322 out of 436 sites or 74% were correctly classified by the experts. This level of accuracy compares favorably to that of land cover maps derived from the analysis of Landsat satellite imagery. It is important to note that the accuracy of the final grassland map should be greater than the above figures because it was revised and corrected based on field data.

Section 3. Forest Land Habitat

These analyses were conducted for a 2004 report by The Nature Conservancy to the Arizona State Land Department.

Spatial distribution of forest types was determined from the 1998 Arizona Gap Analysis Program vegetation data, U.S. Geological Survey. This was augmented with 1994 Arizona Game and Fish data on riparian forests.

Appendix 2: Crosswalk of vegetation communities and forest types.

| Arizona Forest Legacy Program-Forest Type | Gap vegetation categories (1998) | Biotic Communities (Brown 1994) | | |
|--|--|---|---|--|
| Madrean Oak Woodland | Encinal Mixed Oak | Madrean Evergreen Woodland Interior Chaparral | | |
| | Encinal Mixed Oak-Mesquite | | | |
| | Encinal Mixed Oak-Mexican Mixed Pine | | | |
| | Encinal Mixed Oak-Mexican Pine-Juniper | | | |
| | Encinal Mixed Oak-Pinyon-Juniper | | | |
| | Encinal Mixed Oak/Mix Chaparral/Semidesert Grassland-Mix Scrub | | | |
| Pinyon-Juniper Woodland | GB Big Sagebrush-Juniper-Pinyon | Great Basin Conifer Woodland | | |
| | GB Juniper | | | |
| | PJ (Mixed)/Mixed Chaparral-Scrub | | | |
| | PJ-Shrub/Ponderosa Pine-Gambel Oak-Juniper | | | |
| | PJ/Sagebrush/Mixed Grass-Scrub | | | |
| | Pinyon-Juniper (Mixed) | | | |
| | Pinyon-Juniper-Mixed Grass-Scrub | | | |
| | Pinyon-Juniper-Mixed Shrub | | | |
| Conifer Forest | Arizona Cypress | Subalpine Conifer Forest Rocky Mountain and Madrean Montane Conifer Forest | | |
| | Douglas Fir-Mixed Conifer | | | |
| | Englemann Spruce-Mixed Conifer | | | |
| | Ponderosa Pine | | | |
| | Ponderosa Pine-Gambel Oak-Juniper/Pinyon-Juniper Complex | | | |
| | Ponderosa Pine-Mixed Conifer | | | |
| | Ponderosa Pine-Mixed Oak-Juniper | | | |
| | Ponderosa Pine/Pinyon-Juniper | | | |
| | Ponderosa Pine-Mixed Conifer/Shrub Live Oak | | | |
| | Riparian Forest | | GB Riparian Forest/Mixed Riparian Scrub | Montane Riparian Forest/Wetlands Plains and Great Basin Riparian Forest/Wetlands Riparian Deciduous Forests and Woodlands Sonoran Riparian Deciduous Forest and Woodlands |
| | | | GB Riparian/Cottonwood-Willow Forest | |
| Int. Riparian/Cottonwood-Willow Forest | | | | |
| Int. Riparian/Mesquite Forest | | | | |
| Int. Riparian/Mixed Broadleaf Forest | | | | |
| Son. Riparian/Cottonwood-Mesquite Forest | | | | |
| Son. Riparian/Cottonwood-Willow Forest | | | | |
| Son. Riparian/Leguminous Short-Tree Forest/Scrub | | | | |
| Son. Riparian/Mesquite Forest | | | | |
| Son. Riparian/Mixed Broadleaf Forest | | | | |
| Son. Riparian/Mixed Riparian Scrub | | | | |
| Cottonwood-Willow* | | | | |
| Mesquite* | | | | |
| Conifer Oak* | | | | |
| Mixed Broadleaf* | | | | |
| Tamarisk and Russian Olive* | | | | |

* From AZ Game and Fish Department riparian vegetation 1993-1994